International Firms and Environmental Sustainability: Evidence on Emissions Reduction

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ABSTRACT. Since climate change and environmental challenge is a global issue, one would expect global firms to have greater sensibility to global environmental sustainability than domestic firms reflecting global values and stakeholder concerns. A counter argument is that MNCs might be more opportunistic in engaging in regulatory arbitrage concerning emission reduction leveraging their network capability. We find a positive association between firm internationalization and emissions reduction for both U.S. and non-U.S. firms. This supports the new institutionalism theory, suggesting that emissions reduction indicates perceived environmental alignment with global norms by MNCs. Further, the relation between firm internationalization and emissions reduction is mediated by international environmental institutions such as the Kyoto Protocol. The results are robust to alternative modeling assumptions and supported by quasi-natural experiments. We also show that good corporate behavior toward environmental sustainability is accretive to value creation, and especially so for international than domestic firms.

Keywords: Corporate environmental responsibility, emissions reduction, environmental institutions, global stakeholder theory, MNCs

Introduction

After decades of unprecedented growth in global trade and investment and the concomitant emergence of multinational corporations (MNC), there is now a significant political and popular pushback toward economic nationalism (see opposing views by Friedman 2005; Smick 2008). Meanwhile, there is a deeper debate grounded in moral philosophy concerning whether the standard of ethics is defined by universal (global) or relative (national) norm (for a philosophical argument, see Hartman 1975; for a firm-contextual argument, see Wicks 1990). These debates shape our understanding of the role of international institutions such as the Kyoto Protocol and the Paris Agreement, and their implications for environmental sustainability, which is considered one of the most challenging issues facing humanity today (Nordhaus 2018). These institutions aims at limiting the global temperature rise to 1.5 degree Celsius, via greenhouse-gas-emissions, adaptation, and finance, within the United Nations Framework Convention on Climate Change (UNFCCC), signed in 2016.

According to institutional economics (e.g., Commons 1934; North 1990), institutions and changes in institutions such as collective actions of conflicting interest groups such as monopolies, big corporations and labor disputes influence the economic performance and fluctuating business cycles. Meyer and Rowan (1977), DiMaggio and Powell (1983), and Friedland and Alford (1991) extended this to organizations and developed new institutionalism that the behaviors of individuals and organizations are influenced by the surrounding context of institutions and their institutional surroundings, which can, depending on the institutional context, produce isomorphic as well as heterogeneous and strategic responses (DiMaggio & Powell 1991; Lawrence & Suddaby 2006; Schneiberg & Clemens 2006; Dyck, Lins, Roth, & Wagner 2019; Cao, Liang & Zhan 2020). In this view, to gain the environmental legitimacy, MNCs exert efforts to engage in environmental sustainability and disclose the results of such efforts (Marquis et al. 2016). Yet there is no consensus as to how MNCs should be committed to protecting the global environment. This paper aims to provide evidence on emissions reduction efforts taken by MNCs; emissions reduction is one of the most critical factors that firms can undertake to improve on climate and prevent its negative fallout.

In this paper, we empirically investigate the impact of internationalization on firms' decision to engage in emissions reduction activities that underscore firms' perceived environmental responsibility to reduce greenhouse gas emissions. Firm internationalization is the process "through which a firm expands the sales of its goods or services across the borders of global regions and countries into different geographic locations or markets" (Hitt et al. 2007, p. 251). Operationally, the definition of MNCs includes foreign direct investments by green-field investments or acquisitions as well as the extent of continued international operations (Choi and Jiang 2009). As a firm becomes international, it becomes more aligned with international norms and values by learning via their exposures to international culture, business practices, and risks. In addition, an MNC may be more sensitive to environmental concerns because of pressures from international stakeholders. Campbell (2007) suggests that the relationship between economic conditions and socially responsible corporate behavior is mediated by international and national regulations as well as institutionalized norms and stakeholder expectations. Flammer (2015) and Dyck, Lins, Roth, and Wagner (2019) maintain that "new institutions" are motivated not only by financial returns but also by social returns, and Dyck et al. (2019) show that institutional investors transplant their social norms regarding corporate social responsibility (CSR) around the world. Servaes and Tamayo (2014) and Cao, Liang, and Zhan (2020) further maintain that the spillover effect of the adoption of CSR can be a strategic response to competitive threats.

Our study is a test of the new institutionalism theory as it relates to environmental sustainability at the firm level. We expect that firm internationalization (or an MNC) will be associated with greater emissions reduction because of the firm's exposure to global value systems as well as social pressures from international stakeholders, and that such relationship is mediated by environmental institutions and regulations.

Based on a U.S. firm sample of 6,847 observations (985 unique firms) from 2002 to 2014, we find that firm internationalization in a given year has a positive and significant effect on reducing emissions in the same or following year. This finding is consistent with the view from the new institutionalism theory that firm internationalization enhances emissions reduction activities, thus increasing a firm's long-term organizational sustainability and legitimacy. The results are robust to alternative modeling assumptions and after mitigating endogeneity concerns using the quasi-natural experiments around the extreme heat disaster, the BP oil spill, and the Kyoto Protocol. A difference-in-difference method strengthens our main findings of a positive association between firm internationalization and emissions reduction.

Furthermore, we find that environmental regulations and global environmental institutions, such as the Kyoto Protocol mediate the relation between firm internationalization and emissions reduction, contributing to environmental sustainability beyond and above mandated by norms and regulations. Moreover, we observe that emissions reduction can be conducive to value creation, and more so for international firms, suggesting that good corporate behavior in terms of emissions reduction is rewarded. Further analysis based on non-U.S. firms indicates that the positive relation between firm internationalization and emissions reduction is not solely a U.S. phenomenon—it holds true for non-U.S. firms as well. Our unreported results suggest, however, that the positive association is more pertinent in US and in Europe, but not in Asian countries.

The remainder of this paper proceeds as follows. The following section discusses the relevant literature and develops the hypotheses concerning firm internationalization and emissions reduction. The next section presents the sample and research design, followed by a section on empirical results. The last section presents discussions and conclusions.

Hypotheses Development

New Institutionalism Theory and Environmental Sustainability

Institutional theory focuses on understanding the role of institutions in shaping economic behavior, viewing the market as a result of the complex interactions of various institutions including firms, states, and social norms (Hamilton 1919). North (1990) examines the impacts of institutions and changes in institutions on economic performance of firms and nations. The implication is that organizational actions and organizational structure cannot be fully understood without considering specific historical or institutional contexts. Contemporary interest in institutions, i.e., new institutionalism, as a determinant of organizational actions and structures traces its origins to the work by Meyer and Rowan (1977), DiMagio and Powell (1983), and Friedland and Alford (1991). Meyer and Rowan (1977) argue that organizations exist in an institutionalized environment of organizations that embody rules that serve as powerful myths. Organizations align themselves with these new institutionalism rules, and by doing so they come to be seen as legitimate and worthy and thus increase their resources and survival capabilities. DiMagio and Powell (1983) maintain that when organizations align themselves with specific institutional environment, they tend to become "isomorphic" with each other, via three types (coercive, mimetic, and normative) of institutional pressures.

Friedland and Alford (1991) turn away from how similar institutional pressures lead to similar organizational responses to exploring how institutional differences can impose conflicting pressures on organizations. They argue that the main institutions of contemporary Western societies—capitalism, democracy, family, bureaucracy—each has a distinct "institutional logic." It follows that different institutions with distinct institutional logic can influence organizations in different and even contradictory ways by placing conflicting demands on them.

Matten and Moon (2008) assert that institutional differences can describe the differences in the level and type of corporate social responsibility (CSR) decisions, whereas coercive, mimetic, and normative institutional pressures account for their similarities or "isomorphism." Recently, Flammer (2015) and Dyck et al. (2019) argue that new institutions are motivated by both financial and social returns, and Dyck et al. (2019) show that institutional investors transfer their social norms regarding CSR around the world. Servaes and Tamayo (2014) and Cao et al. (2020) further assert that the overflow effect of the CSR adoption is a strategic response to competitive threat.

We label this as "new institutionalism theory" that suggests that institutional behaviors, including CSR and environmental engagement or the way institutions aim to act responsibly for environment and society, and to prevent climate change by reducing emissions, are therefore affected by the socio-economical institutions in which firms operate (Aguilera, Rupp, Williams, & Ganapathi 2007; Matten & Moon 2008; Dyck et al. 2019; Cao, Liang, & Zhan 2020).

The socio-economic institutional complexity refers to a variety of institutional logics (Greenwood et al. 2010), which correspond to different societal institutional orders, such as the market, the state, and the community (Servaes and Tamayo 2014; Lee et al. 2015; Cao, Liang, & Zhan 2020). The market logics focus on shareholder value maximization through stock price appreciation and dividend increases. The state logics shape rule-following behaviors such as the peer effects of CSR (Servaes and Tamayo 2014; Cao, Liang, & Zhan 2020). We argue that the community logics dictate good corporate citizenship through reductions in negative externalities such as emissions and pollution.

The lesson of the new institutionalism theory, is that the institutions surrounding a firm influence the corporate decisions. We postulate that firm internationalization influences corporate decisions on emission reductions, depending on the effect of institutionalized norms and social pressures. This leads to our first hypothesis that firm internationalization is positively associated with higher emissions reduction activities for environmental sustainability independent of whether this is good for shareholder value (we examine the effect on firm value later).

H1: The degree of firm internationalization is positively associated with emissions reduction activities.

As discussed above, fundamentally the firm's sensitivity to environmental sustainability is guided by the belief of the firm (CEO, shareholders, and stakeholders) toward a global rather than a national norm. However, it is unclear whether MNCs would always behave in a globally responsible way. Strike, Gao and Bansal (2006) argue that MNCs can be both socially responsible and socially irresponsible, depending on whether resource-based opportunities afforded by international diversification are effectively utilized by learning across network (Kogut 1985). For example, MNCs are known to engage in pollution industries, and many of them are relocated to countries with low cost and least public resistance (Rugman and Verbeke 1998). Another example is workplace conditions that may be acceptable by the host-country standard but unacceptable by the home-country standard; thus, MNCs may be viewed socially irresponsible at home while acceptable abroad (Strike et al., 2006).

The possibility of socially irresponsible behavior by an MNC and its potentially devastating consequences on climate change and global warming, calls for national and international environmental institutions that can monitor corporate behavior and obtain solutions to global environmental challenges. The former might be voluntary or informal international codes of conducts for MNCs administered by NGOs, and the latter the international governmental treaties concerning time-dependent national targets of greenhouse emissions and negotiated measures to achieve them. National regulations are insufficient for this purpose.

Only internationally can countries collaborate to limit pollutions and keep global air temperature under a certain level. This leads to our second hypothesis, which is on the mediating influence of environmental regulations that affect the relation between firm internationalization and emissions reduction. This is an extension of the new institutionalism theory as it relates to the *prima facie* international institutions such as the Kyoto Protocol, the Paris Accord, or the like.

H2: The effect of firm internationalization on emissions reduction is positively mediated by global regulatory institutions pertaining to environmental sustainability.

Data and Variables

Data

To construct our sample, we first collect firm-level data for emissions reduction ratings over 2002–2014 from the ASSET4 database provided by Thomson Reuters. Next, we merge the data for emissions reduction with financial information from all U.S. firms listed on the New York Stock Exchange (NYSE), American Stock Exchange (AMEX), and NASDAQ, obtained from the Compustat. Later, we merge this sample with data for geographic segments retrieved from the Compustat Segments file and obtain a sample of 985 companies and 6,847 firm-year observations. For the non-US sample, we combine ASSET4 and Worldscope databases.

Variables

We first focus on the normalized ASSET4 ratings of firms' emissions reduction to measure their environmental commitment. To examine the relation between emission reduction and firm globalization, we employ eight measures of firm internationalization. Finally, we also examine whether MNCs' emissions reduction activities are rewarded in terms of firm value, measured by Tobin's Q and the market-to-book ratio (MTB). In the regression analyses, we include a set of control variables used by Servaes and Tamayo (2013, 2014) and Cai et al (2016). Definitions of variables and data sources are provided in Appendix A and their construction is detailed as follows.

Emissions Reduction

We employ the ASSET4 ESG ratings on emissions reduction (EMREDUC) to measure firms' overall activities of reducing emissions. Those ratings are solely based on transparent information collected by over 125 research analysts from publicly available sources, such as annual corporate reports, CSR reports, and NGO websites. Each company's emissions reduction is evaluated by 41 data point questions (Appendix B), answers to which are rigorously verified. The rating scores are normalized between 0 and 100%, indicating how many units of standard deviation each firm's emissions reduction rating deviates from the sample mean. In our study, we convert those rating scores into decimals, a higher value of EMREDUC corresponding to greater sensibility to emissions reduction.

Internationalization Variables

Following the sustainability literature (e.g., Hitt et al. 1997; Sanders and Carpenter 1998; Black et al. 2014; Attig et al. 2016; Dyck et al. 2019), we construct eight variables based on geographic segment data to measure firms' internationalization. These internationalization variables comprise two dummy variables indicating whether a firm has foreign sales (D(FS)) or assets (D(FA)), the ratio of foreign sales to total sales (FS/S), the sales Herfindahl index (Herfindahl_S), the sales entropy index (Entropy_S), the ratio of foreign assets to total assets (FA/A), the assets Herfindahl index (Herfindahl_A), and the assets entropy index (Entropy_A). All of these variables are consistent with the notion that firm internationalization involves the process "through which a firm expands the sales of its goods or services across the borders of global regions and countries into different geographic locations or markets" (Hitt et al. 2007 p.251) and Dyck et al.'s (2019) assertion that geographical location matters.

These internationalization measures are constructed as follows. After obtaining geographic segments data for U.S. companies from the Compustat segments file, we identify firms' domestic and foreign segments by their Geographic segment type (GEOTP). Specifically, a domestic company reports data for only one domestic segment (i.e., GEOTP = 1), whereas a multinational company reports financial data for both domestic (i.e., GEOTP = 2) and foreign (i.e., GEOTP = 3) segments.[1] It is thus straightforward to denote two dummy variables, D(FS) and D(FA), as indicating whether a firm has nonzero foreign sales or assets. Furthermore, we compute a firm's total sales and identifiable assets by summing them across all geographic segments and thus arrive the ratio of FS/S or FA/A, respectively, as foreign sales or assets over total sales or assets. These two foreign sales or assets ratios capture an MNC's overall dependence on foreign consumer markets and foreign resources.[2]

In addition, we construct the Herfindahl index and the entropy index to describe how a firm's sales or assets are distributed across different geographic segments. Suppose that a firm has N geographic segments and that segment i generates sales s_i or possesses identifiable assets a_i; sales- and asset-based indices are computed as follows:

$$\text{Herfindahl(S)} = \sum_{i=1}^{N}\left(s_i/\sum_{i=1}^{N} s_i\right)^2 \tag{1}$$

$$\text{Entropy(S)} = -\sum_{i=1}^{N}\left(s_i/\sum_{i=1}^{N} s_i\right)\cdot\ln\left(s_i/\sum_{i=1}^{N} s_i\right) \tag{2}$$

$$\text{Herfindahl(A)} = \sum_{i=1}^{N}\left(a_i/\sum_{i=1}^{N} a_i\right)^2 \tag{3}$$

$$\text{Entropy(A)} = -\sum_{i=1}^{N}\left(a_i/\sum_{i=1}^{N} a_i\right)\cdot\ln\left(a_i/\sum_{i=1}^{N} a_i\right). \tag{4}$$

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[1] In the Compustat segments file, an MNC reports at least one foreign segment whose GEOTP number is 3. When an MNC has multiple foreign segments, we sum sales or assets across all foreign segments to measure its total amount of foreign sales or assets.

[2] According to Sanders and Carpenter (1998), foreign assets proxy for foreign stock holdings, whereas foreign sales proxy for firms' sales to foreign markets.

By definition, a more internationalized company exhibits a lower Herfindahl index value and a higher entropy index value, whereas a purely domestic company has a Herfindahl index of 1 and an entropy index of 0.

Firm Value Variables

A widely used measure of firm value is Tobin's Q, which is the preset value of a firm's future cash flows divided by its replacement costs of tangible assets. Following Lang and Stulz (1994), we compute Tobin's Q as the sum of market value of common equity, book value of debt, and preferred stock divided by book value of total assets. Another popular measure of firms' equity value is MTB, the ratio of market value of equity over book value of equity.

Control Variables

To address the potential impact of firms' attributes on the relation between internationalization and emissions reduction, we control for several firm characteristics. Following Servaes and Tamayo (2013, 2014), Jo et al. (2015), and Albuquerque et al. (2019), our control variables are firm size (Ln(at)), leverage (Lev), market-to-book ratio (MTB), profitability (ROA), capital expenditures (Capex), free cash flows (FCF, computed as income before extraordinary items plus depreciation), R&D intensity (RD/S), advertising expenses (AD/S), long-term assets (PPE, indicating property, plant, and equipment), and cash holdings (Cash).

Empirical Results

Univariate Analysis

Panel A of Table 1 provides summary statistics for the variables employed in our study. All continuous variables are winsorized at the 1st and 99th percentiles. The emissions reduction index, EMREDUC, has a mean of 0.426, standard deviation of 0.309, and ranges from 0.081

to 0.963, exhibiting substantial variation across firms. For firm internationalization variables, D(FS) and D(FA), respectively, define 72.4% and 23.5% of firm-year observations as MNCs.[3] Continuous measures of internationalization based on foreign sales, FS/S, Herfindahl(S), and Entropy(S), have means of 0.302, 0.61, and 0.741, respectively. Although the three measures based on foreign assets have fewer observations because of missing data for foreign assets, FA/A, Herfindahl(A), and Entropy(A) are distributed in reasonable ranges, with means of 0.424, 0.716, and 0.512, respectively. Turning to firm value variables, Tobin's Q and MTB ratio have means of 2.013 and 3.718, respectively. Taken together, the summary statistics suggest that our sample consists of a wide cross-section of firms, particularly for the emissions reduction, internationalization, and firm value variables.

Panel B of Table 1 reports bivariate correlations between variables of interest. The emissions reduction index is strongly associated with all internationalization variables, suggesting that MNCs take more responsibility for environmental concerns than do local companies and that more internationalized MNCs contribute more to reducing hazardous emissions. Furthermore, emissions reduction activities are related to firm size, leverage ratio, and capital expenditures, indicating that larger, highly levered, and investment-oriented firms do a better job at reducing emissions. Moreover, the internationalization variables are strongly linked to the firm value variables, suggesting that more internationalized firms maintain higher firm value.

[Table 1 about here]

Multivariate Relation between Internationalization and Emissions Reduction

[3] Because firms in the sample have more missing value for foreign assets than for foreign sales, the dummy variable D(FA) denotes fewer MNCs than D(FS) does. For the same reason, FA/A has fewer observations than FS/S

Baseline Regression Results

To examine the relation between internationalization and emissions reduction, we conduct the following baseline regression model, regressing the emission reduction index (EMREDUC) on the internationalization variables, controlling for firm characteristics, such as the logarithm of total assets, leverage, MTB ratio, ROA, capital expenditure, free cash flow, R&D-to-sales ratio, advertisement-to-sales ratio, ratio of property, plant, and equipment divided by total assets (PPE), and cash-to-total-assets ratio. We also include year dummies to control for changing economic conditions and industry dummies to control for industry-specific effects.

$$\text{EMREDUC} = \alpha + \beta^{*}\ \text{internationalization} + \sum \gamma_j * \text{control}_j + \varepsilon. \tag{5}$$

We report the regression results in Table 2, including four internationalization measures based on foreign sales. In the first column, the coefficient estimate of D(FS) is 0.089 (t = 11.759). The positive coefficient suggests that multinational companies do more to reduce hazardous emissions than do local companies. In the second column, the coefficient estimate of FS/S is 0.156 (t = 10.922), suggesting that a one-standard-deviation increase in FS/S is associated with a 4.35% (= 0.156*0.279) average increase in emissions reduction. Similar results are found with Herfindahl(S) and Entropy(S). In the third column, the negative coefficient of −0.198 (t = 15.532) for Herfindahl(S) is consistent with the positive association between internationalization and emissions reduction, as a more internationalized firm maintains a lower Herfindahl index value. In the fourth column, the coefficient estimate of Entropy(S) is 0.093 (t = 14.962). In unreported regressions, we also find similar positive relations between internationalization and emissions reduction based on asset-based internationalization measures. Taken together, these results suggest that firms are more committed to emissions reduction activities as they become more globalized, which supports H1.

[Table 2 about here]

Different Estimation Methods

To ensure that the estimate of β in equation (5) is robust to different estimation methods, we conduct a two-way clustering regression (clustered by firm and year), panel regression with firm fixed and random effects, Fama–MacBeth (1973) regression, Prais–Winsten (1954) regression taking care of serial correlation, and generalized method of moments (GMM) estimation (Hall 2005). We report the results for FS/S using different estimation methods in Table 3.[4] The coefficient of FS/S remains positive and significant under each estimation method. For instance, a one-standard-deviation increase in the FS/S ratio is associated with a 6.78% (= 0.243*0.279) average increase in emissions reduction under the two-way clustering regression method. Results in Table 3 suggest that the positive relation between internationalization and emissions reduction is robust to omitted variables, unobservable firm characteristics, and cross-sectional and serial dependence of the data, and the relation is statistically and economically significant.

[Table 3 about here]

Test on Environmental Regulation

So far, our baseline tests are designed to examine the new institutionalism theory. It may be that the empirical association between firm internationalization and emissions reduction comes from some other factor, such as regulation. We first verify whether some U.S. environmental regulation could be the factor that drives the positive firm internationalization–emissions reduction association.

Within our sample period, on July 27, 2005, the Bush Administration announced the formation of a six-nation Asian Pacific Partnership on Clean Development and Climate (APP).

[4] Results of other internationalization variables are qualitatively identical and available upon request.

The goal of the APP meeting is “national pollution reduction, energy security and climate change concerns,” consistent with the principles of the U.N. Framework Convention on Climate Change (UNFCCC). The APP regulation was implemented later in 2005. Thus, we divide the full sample into pre-APP (2002-2005) and post-APP (2006-2014) subsamples and run the previous regression model (5) with each subsample.

Table 4 presents the results, the pre-APP results in Panel A and the post-APP results in Panel B. As anticipated, we find that the significance of the coefficients on firm internationalization measures is stronger in the post-APP period than in the pre-APP one, lending support for the proposition that regulation affects emissions reduction. However, all coefficients on the firm internationalization variables from both panels are, in general, significant and consistent with our main findings regardless of the APP regulation. Thus, we conclude that the APP regulation does mediate the firm internationalization–emissions reduction linkage.

[Table 4 about here]

In addition, Panel C reports the *F statistics* of Chow test for any structural break in the coefficients of internationalization variable between the two subsample periods, before and after the APP. The results suggest that the regulation indeed intensifies the relationship between firm internationalization and emissions reduction, supporting H2.

Difference-in-Difference Analysis

To address endogeneity concerns due to reverse causality, we conduct a difference-in-difference analysis based on two quasi-natural experiments.

The first is the extreme temperature disaster (ETD), the summer 2006 North American heat wave. The heat wave that hit North America from July 15, 2006 to August 27, 2006 was severe and affected most of the United States and Canada, killing at least 225 people.[5] Such a natural disaster might involve significant firm internationalization activities to reduce hazardous gas emissions. We thus employ the ETD as an exogenous shock to determine how the disaster affected the relation between firm internationalization and emissions reduction.

The second quasi-natural experiment is the BP oil spill (BPOS), also referred to as Deepwater Horizon oil spill, an industrial disaster in the petroleum industry that began in April 2010. The spill directly affected 68,000 square miles of ocean and reached many distant coasts, raising concerns about further underwater contamination. It spurred tremendous efforts to resolve the oil spill, which might have also triggered firm internationalization activities toward environmental protection. Consequently, the BPOS is regarded an ideal quasi-natural experiment to study the relation between firm internationalization and emissions reduction.

Our difference-in-difference analysis proceeds as follows. First, we create two dummy variables, corresponding to the two quasi-natural experiments. Specifically, to explore how the relation between firm internationalization and emissions reduction changed before and after the ETD in 2006, we create a dummy variable, denoted ETD, which equals 1 after the North American heat wave in 2006 and 0 otherwise. Similarly, to examine how the relation between firm internationalization and emissions reduction changed around the BPOS, we create a

[5] Temperatures hit 118°F (48°C) on July 21, 2006 in Phoenix, making it the hottest day since 1995 and one of the 11 hottest since 1895, when temperature records were first kept in the city. California temperatures began reaching record levels by July 22. In one section of Los Angeles, Woodland Hills, the temperature reached 119°F (49°C), making it the highest recorded temperature in the county, and within the city border it broke the old record of 118°F in Canoga Park. The unusual daytime heat resulted in extremely high overnight temperatures. Needles, California recorded a low temperature of 100°F at 5 am on July 23, and in the LA basin the same night, Burbank recorded an overnight low of 77°F (25°C). The California heat wave broke local records. According to some reports, it was "hotter for longer than ever before, and the weather patterns that caused the scorching temperatures were positively freakish." Fresno, in the central California valley, had six consecutive days of 110°F-plus temperatures. Beginning July 31 and into early August, the Midwest, Ontario, Canada, and Atlantic states also began experiencing the heat. Temperatures approached the 100°F mark in Rochester, New York on August 1 and were coupled with the highest dew points the area has experienced in over 51 years. The heat index reached 110°F that day. La Guardia Airport in New York City recorded three consecutive days above 100°F. The temperature peaked at 102°F on August 2. Colonial Downs, a horse track in New Kent County, Virginia, canceled horse racing because of the 100°F heat. The Saratoga Race Course, north of Albany, canceled horse racing for the first time in its history on August 2. By August 8, the heat wave had passed for most areas, but persisted in the South and Southeast, with continued reports of mortality in Oklahoma.

dummy variable, denoted BPOS, which equals 1 after the BP Oil Spill in 2010 and 0 otherwise. Second, we run the following regression model by including the interactive term of internationalization and ETD or BPOS dummy:

$$\text{EMREDUC} = \alpha + \beta\text{*internationalization} + \delta\text{*ETD or BPOS} + \lambda * (\text{internationalization*ETD or BPOS}) + \sum \gamma_j\text{*control}_j + \varepsilon. \quad (6)$$

Table 5 presents the regression results based on three measures of firm internationalization: FS/S, Herfindahl(S), and Entropy(S). In Panel A, when ETD is employed as an exogenous shock, the coefficient on ETD is positive and significant in three models, suggesting that firms' emissions reduction performance was significantly improved after the ETD disaster. In model (1), the interactive term between FS/S and ETD has a coefficient of 0.066 (t = 1.668). Even stronger results are found in models (2) and (3), as the interactive term between ETD and Herfindahl(S) has an estimate of −0.096 (t = 2.67) and the interactive term between ETD and Entropy(S) has an estimate of 0.046 (t = 2.616). Results in Panel A suggest that firms' internationalization improved emissions reduction activities after the ETD disaster.

In Panel B of Table 5, similar results are observed for the BP oil spill (BPOS) experiment. The BPOS dummy is positive and significant in three models (models (4) to (6)), indicating that firms were committed to reducing a larger amount of emissions after the oil spill. The three interactive terms, FS/S*BPOS, Herfindahl(S)*BPOS, and Entropy(S)*BPOS, are all significant, and their estimates are 0.067 (t = 2.394), −0.064 (t = 2.478), and 0.027 (t = 2.14), respectively. Once again, the results imply that firms' internationalization significantly increased emissions reduction performance after the BPOS disaster.

[Table 5 about here]

Evidence from Non-U.S. Countries

Having observed the association between firm internationalization-emissions reduction in the U.S., we provide further evidence using a cross-country data set of non-U.S. countries.

The non-U.S. sample is constructed as follows. First, we collect the emissions reduction ratings of all non-U.S. firms from the ASSET4 database. Next, with the International Securities Identification Number (ISIN) identifiers of those firms, we can download the internationalization variable, the ratio of foreign sales over total sales, together with other financial variables from the Worldscope database. After merging the emissions reduction ratings with the financial variables, we require each country to have at least five firms over 2002–2014. To achieve a broad coverage of firms, we set the missing FS/S ratio to zero. Our final sample of non-U.S. firms consists of 15,728 observations from 41 countries, which are Australia, Austria, Belgium, Hong Kong, Brazil, Canada, the Switzerland, Chile, Germany, Denmark, Egypt, Spain, Finland, France, the United Kingdom, Greece, China, Indonesia, Ireland, Israel, Italy, Jersey, Japan, South Korea, Luxembourg, Mexico, Malaysia, the Netherlands, Norway, New Zealand, Philippines, Poland, Portugal, Russia, Saudi Arabia, Singapore, Sweden, Thailand, Turkey, Taiwan, and South Africa.

We run regression model (5) with the non-U.S. data under different estimation methods and present results in Table 6. In the first column, the OLS estimate on FS/S is 0.058 (t = 8.646), suggesting that a one-standard-deviation increase in FS/S increases EMREDUC by 2% (= 0.058*0.344). In the second column, the two-way clustered estimate is 0.062 (t = 4.776). In the third and fourth columns, the estimates of the fixed and random effects in the panel regressions are 0.053 (t = 3.983) and 0.051 (t = 5.038), respectively. In the last two columns, the Fama–MacBeth (1973) and Prais–Winsten (1954) estimates are 0.051 (t = 5.359) and 0.044 (t = 5.501), respectively. The results in Table 6 suggest that the positive relation between firm internationalization and emissions reduction is pervasive among non-U.S. firms. We also examine whether the same relation is pervasive in a particular country such as Japan. In our un-tabulated results, we find the same positive firm internationalization-emission reduction relation in Japan. Put together, the findings from non-U.S. firms are in support of H1.

[Table 6 about here]

Furthermore, we consider the Kyoto Protocol as a quasi-natural experiment, and examine how the relation between firm globalization and emission reduction varies with the implementation of the Kyoto Protocol for the non-U.S. sample (see the history of the Kyoto Protocol in Appendix C). Specifically, we create a dummy variable, KP, which is equivalent to one after the Kyoto Protocol was enacted in year 2005 and zero otherwise. We then run the following regression model including the interactive term of globalization and KP dummy:

$$\text{EMREDUC} = \alpha + \beta * \text{internationalization} + \delta * \text{KP} + \lambda * (\text{internationalization} * \text{KP}) + \sum \gamma_j * \text{control}_j + \varepsilon \qquad (7)$$

where the dependent variable is the emission reduction (EMREDUC), and globalization is measured by four sales-based globalization variables, which are D(FS), FS/S, Herfindahl(S), and Entropy(S). Controlling variables are the same as in equation (5). We also control for the year-fixed and industry-fixed effect and adjust t-statistics by heteroscedasticity-consistent standard errors.

Table 7 presents the regression results of equation (7). Specifically, model (1) shows that the interactive term between D(FS) and KP is estimated as 0.090 (t=6.241), suggesting that the enactment of Kyoto Protocol widens the gap of emission reduction between MNCs and domestic companies. In models (2) to (4), the coefficients on the three interactive terms between firm globalization and Kyoto Protocol dummy are all significant. The coefficients and significance are 0.202 (t=5.627) on the interactive term of FS/S and KP, -0.071 (t=-3.037) on the interactive term of Herfindahl(S) and KP, and 0.037 (t=3.064) on the interactive term of Entropy(S) and KP, respectively. These results suggest that the implementation of the Kyoto Protocol, in general, tends to strengthen the relationship between environmental regulation and firm globalization-emission reduction linkage, further supporting H2.

[Table 7 about here]

Evidence from Alternative Database

In addition to the ASSET4 database, the Kinder, Lydenberg, and Domini (KLD) Stats database is an alternative popular source for firm's environmental activities. We thus use the data from the KLD Stats database as another robustness check. The KLD Stats database provides an inclusive social rating, which covers approximately 80 strengths and concerns across seven major qualitative issue areas, including community, corporate governance, diversity, employee relations, environment, human rights, and product. Our dataset covers approximately 650 firms from either the S&P 500 index or the Domini 400 Social Index before 2001. After 2001, we use the KLD's ratings, which cover approximately 1,100 to 3,100 firms from the S&P 500 index, Domini 400 Social Index, and Russell 1000 (Russell 3000) index. As the KLD's ratings were updated in 2002 by incorporating human rights, we collected the ratings from 2002 to 2014 and constructed an index for aggregating each individual rating as per Harjoto, Jo, and Kim (2017). The Environmental index (Environmental FF12 Index) is thus calculated as:

$$Environmental\ Index\ for\ firm\ i\ in\ year\ t =$$

$$\frac{(Environment_{i,t}\ net\ count\ for\ firm\ i\ at\ year\ t - Min.Environment_{i,t}\ net\ count\ firm\ i's\ industry\ at\ year\ t)}{(Max.Environment_{i,t}\ net\ count\ for\ firm\ i's\ industry\ at\ year\ t - Min.Environment_{i,t}\ net\ count\ for\ firm\ i's\ industry\ at\ year\ t)}$$

$$Environmental\ FF12\ index\ for\ firm\ i\ in\ year\ t =$$

$$\frac{(Environment_{i,t}\ net\ count\ for\ firm\ i\ at\ year\ t - Min.Environment_{i,t}\ net\ count\ firm\ i's\ at\ year\ t)}{(Max.Environment_{i,t}\ net\ count\ for\ firm\ i's\ at\ year\ t - Min.Environment_{i,t}\ net\ count\ for\ firm\ i's\ at\ year\ t)}$$

With the Environmental Index (Environmental FF12 index) as the dependent variable, we run the regression model (5). The regression results are presented in Table 8, including four internationalization measures based on foreign sales. We consistently find a positive relationship between firm internationalization and the environmental index. Specifically, in the first column, the coefficient on FS/S is 0.017 (t = 3.818). In the second column, the negative coefficient of −0.009 (t = -2.128) for Herfindahl(S) is consistent with the positive association between internationalization and the Environmental Index, as more international firm maintains a lower Herfindahl index value. In the third column, the coefficient of Entropy(S) is estimated 0.006 (t = 2.358). As before, the results from using the asset-based internationalization measure are qualitatively the same. In sum, we obtain similar results by an alternative measure, the Environmental FF12 index constructed by data from the KLD database. The results consistently suggest that firms are more committed to emission reduction as they become more internationalized, which confirm our earlier findings.

[Table 8 about here]

Impact of Emissions Reduction on Firm Value

After documenting the firm internationalization-emissions reduction relationship using both the U.S. and non-U.S. sample, we additionally analyze whether MNCs' efforts to contribute to environmental sustainability are rewarded in terms of value creation. There are several reasons why such expectation may be plausible. First is the ecological one. We start with a premise that the economy is part of the society, which in turn is part of a larger ecological system. Within it, Markman et al. (2016) argue that complex dimensions of sustainability require a balance among environmental, social, and economic systems. An underlying thread in the literature on corporate environmental responsibility (CER) is similar: through a complex web of stakeholder constituents (such as customers, suppliers, shareholders, creditors, employees, environmental activists, or the community), environmentalism is being transformed from something external to the market to one that is internal, consistent with the core objective of the firm. Empirical research on CSR supports such a view although empirical support for CER is relatively slim.[6]

[6] For market's attitude toward CSR, see Klassen and McLaughlin (1996), Kassinis and Vafeas (2006), Jo et al. (2015), Cai et al. (2016). Klassen and McLaughlin (1996), in particular, suggest that improved financial

Second, CER can enhance firm legitimacy and hence firm valuation (Cai et al. 2016). They report that CER by U.S. firms reduced firm risk, supporting the value enhancement hypothesis.[7] Albuquerque et al. (2019) also show that CSR reduces firm risk. Together, we posit that firm internationalization increases the effect of emissions reduction activities on firm value.

Specifically, the empirical investigation is based on the following equation:

$$\text{Value} = \alpha + \beta\text{*internationalization} + \delta\text{*EMREDUC} + \lambda\text{*internationalization*EMREDUC} + \sum \gamma_j \text{*control}_j + \varepsilon, \quad (7)$$

where firm value is measured by Tobin's Q and the MTB ratio, and the internationalization variable is proxied by FS/S. We control for the logarithm of total assets, leverage, and capital expenditure.

Table 9 reports the regression results using the U.S. sample. Tobin's Q results show that the interactive term between FS/S and EMREDUC is positive and significant under the two-way clustering estimation in model (1), and under the ordinary least squares (OLS) estimation controlling for year and industry fixed effects and adjusting *t*-statistics by firm- and year-clustered standard errors. When the MTB ratio is the dependent variable, the interactive term between FS/S and EMREDUC continues to be significant and positive under the two estimation methods. Taken together, these results indicate that more internationalized firms consider their long-term firm value important while contributing to emissions reduction.

[Table 9 about here]

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performance can result from CER. Kassinis and Vafeas (2006) find that stakeholders are concerned about the environment.

[7] Critics argue that firms waste valuable resources through CER; hence, a reduction in CER, not an increase, improves firm performance (Brammer et al. 2006).

Discussion

Our study makes a couple of contributions. The first is to the organization behavior, finance, and international business literature. Our study shows that the choices managers make with respect to firm internationalization influence emissions reduction. Specifically, one of the factors underlying managerial emissions reduction is the degree of firm internationalization, a factor that has been examined much in the literature on business ethics, international business, and finance.

Our second contribution is related to environmental sustainability. A company's environmental policies are generally seen in the literature as part of its CSR (Mitchell et al. 1997; Crane and Matten 2004; Cai et al. 2016; Dyck et al. 2019; Cao et al. 2020). Our study shows that emissions reduction consideration is influenced by a firm's globalization stance, because internationalization is one of the factors that plays a key role in managerial decisions to invest in environmental initiatives and sustainability.

Our study has a few limitations. First, it considers only the influence of firm internationalization on the decision to reduce emissions. There are clearly other factors influencing this decision, such as economic considerations including the availability of capital to fund emissions reduction initiatives, social and political factors, and legal considerations. All of these factors undoubtedly exert some influence, and some may even exert influence that cannot be ignored. Our study is confined to a limited portion of the wide-ranging factors that can influence and motivate a firm's decision to reduce emissions and to prevent climate change.

Second, our study mainly looks at U.S. firms and examines non-U.S. sample only as a robustness check. Because the United States is different from other countries in its culture, legal framework, and political sensibility, as well as being the preeminent economy, comparative studies of how firm internationalization, emissions reduction decisions, and climate change interact remain fruitful areas for future work. One area that might also be interesting to examine is how the emissions reduction decision in specific regions, for example, North America, Europe, Asia, and other part of the world, is affected by firm internationalization and how those differences affect climate change differently.

Overall, despite these limitations, we consider our main empirical findings of a positive association between firm internationalization and emissions reduction initiatives to be an important first step in understanding how the internationalization–emissions reduction nexus affects organization, environment, and the economy.

Conclusion

Over the past several decades, environmental responsibility and sustainability has drawn considerable interest from academics, practitioners, and regulators because managers increasingly internalize environmental concerns as part of their private business computations. Despite the increase in environmental concerns and the growing global demand for environmental protection and climate change, there has been little research into the measurable economic consequences of the relation between firm internationalization and emissions reduction activities.

In this article, we examine the empirical influence of firm internationalization on emissions reduction for a comprehensive sample of U.S. and non-U.S. firms from 2002 to 2014. We find that emissions reduction is positively associated with firm internationalization after controlling for various firm characteristics. This positive association holds even after using alternative internationalization measures and various econometric techniques to address potential endogeneity. The results we obtain are consistent with the new evolved institutionalism theory. Beyond global vs. domestic consideration, we also find that environmental regulations positively influence the relation between firm globalization and emission reduction.

Our study demonstrates that emissions reduction initiatives are generally associated with higher levels of firm internationalization, a stance that scholars of international business, finance, organization behavior and environmental studies might see as a positive influence. This positive impact of firm internationalization provides alternative evidence to the premise of what we call the "shareholder wealth maximization" view. Because emissions reduction initiatives typically require initial investments that do not offer a short-term payoff and are not likely to have a positive return even in the long run, the popular notion is that firms will not invest in emissions-reduction initiatives unless legally required to do so. Contrary to this profit-based intuition, our results suggest that investors, financial managers, and other stakeholders, including policy makers dealing with emissions reduction initiatives, should pursue environmentally friendly policies that may not only contribute to global environmental sustainability in which all entities depend on, but also is beneficial to firm value especially for international firms.

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Appendix A. Variable description and data sources

Variable	Description	Source
Emissions reduction		
EMREDUC	Emissions reduction index indicates firms' efforts to reduce emissions such as carbon dioxide (CO_2), sulfur oxides (SOx), and nitrogen oxides (NOx).	Thomson Reuters ASSET4
Internationalization variables		
D(FS)	Dummy variable equal to 1 if firms have nonzero foreign sales, and 0 otherwise.	Compustat
D(FA)	Dummy variable equal to 1 if firms have nonzero foreign assets, and 0 otherwise.	Compustat
FS/S	Ratio of foreign sales to total sales, where foreign sales is defined as the sum of sales of all foreign segments	Compustat
Herfindahl (S)	For a firm with *N* geographic segments, the sales Herfindahl index is defined as $\sum_{i=1}^{N}(s_i/\sum_{i=1}^{N} s_i)^2$, where s_i stands for sales in geographic segment i.	Compustat
Entropy(S)	For a firm with *N* geographic segments, the sales entropy index is defined as $-\sum_{i=1}^{N}(s_i/\sum_{i=1}^{N} s_i)\cdot\ln(s_i/\sum_{i=1}^{N} s_i)$, where s_i stands for sales in geographic segment i.	Compustat
FA/A	Ratio of foreign assets to total assets, where foreign assets is defined as the sum of assets of all foreign segments.	Compustat
Herfindahl (A)	For a firm with *N* geographic segments, the assets Herfindahl index is defined as $\sum_{i=1}^{N}(a_i/\sum_{i=1}^{N} a_i)^2$, where a_i stands for assets in geographic segment i.	Compustat
Entropy(A)	For a firm with *N* geographic segments, the assets entropy index is defined as $-\sum_{i=1}^{N}(a_i/\sum_{i=1}^{N} a_i)\cdot\ln(a_i/\sum_{i=1}^{N} a_i)$, where a_i stands for assets in geographic segment i.	Compustat
Firm value variables		
Tobin's Q	(Total assets – total common equity+ market capitalization) divided by total assets.	Compustat
MTB	Ratio of market value of equity to book value of equity.	Compustat
Control variables		
Ln(at)	Logarithm of total assets.	Compustat
Lev	Ratio of book value of debt to total assets.	Compustat
ROA	Ratio of net income divided by total assets.	Compustat
Capex	Ratio of capital expenditure divided by total assets.	Compustat
FCF	Ratio of cash flow divided by lag of total assets.	Compustat
R&D/S	Ratio of research and development expense divided by total sales.	Compustat
AD/S	Ratio of advertising expense divided by total sales.	Compustat
PPE	Ratio of property, plant, and equipment divided by total assets.	Compustat
Cash	Ratio of cash and short-term investment divided by total assets.	Compustat

Appendix B. A list of the data point questions for ASSET4 ratings on emissions reduction

Indicators	Definition
Emissions	Does the company describe, claim to have or mention processes in place to improve emission reduction?
Emissions	Has the company set targets or objectives to be achieved on emission reduction?
Biodiversity Impact Reduction	Does the company report on its impact on biodiversity or on activities to reduce its impact on the native ecosystems and species, as well as the biodiversity of protected and sensitive areas?
CO_2 Equivalents Emission Total	Total CO_2 and CO_2 equivalents emission in tonnes.
CO_2 Equivalents Emission Direct	Direct CO_2 and CO_2 equivalents emission in tonnes.
CO_2 Equivalents Emission Indirect	Indirect of CO_2 and CO_2 equivalents emission in tonnes.
Flaring Gases	Total direct flaring or venting of natural gas emissions in tonnes.
Cement CO_2 Equivalents Emission	Total CO_2 and CO_2 equivalents emission in tonnes per tonne of cement produced.
Ozone-Depleting Substances	Total amount of ozone depleting (CFC-11 equivalents) substances emitted in tonnes.
NO_x and SO_x Emissions Reduction	Does the company report on initiatives to reduce, reuse, recycle, substitute, or phase out SO_x (sulfur oxides) or NO_x (nitrogen oxides) emissions?
NO_x Emissions	Total amount of NO_x emissions emitted in tonnes.
SO_x Emissions	Total amount of SO_x emissions emitted in tonnes.
VOC Emissions Reduction	Does the company report on initiatives to reduce, substitute, or phase out volatile organic compounds (VOC)?
Particulate Matter Emissions Reduction	Does the company report on initiatives to reduce, substitute, or phase out particulate matter less than ten microns in diameter (PM10)?
VOC Emissions	Total amount of volatile organic compounds (VOC) emissions in tonnes.
Waste Total	Total amount of waste produced in tonnes.
Non-Hazardous Waste	Total amount of non-hazardous waste produced in tonnes.
Waste Recycled Total	Total recycled and reused waste produced in tonnes.
Hazardous Waste	Total amount of hazardous waste produced in tonnes.
Water Discharged	Total volume of water discharged in cubic meters.
Water Pollutant Emissions	Total weight of water pollutant emissions in tonnes.
Waste Reduction Total	Does the company report on initiatives to recycle, reduce, reuse, substitute, treat or phase out total waste?
e-Waste Reduction	Does the company report on initiatives to recycle, reduce, reuse, substitute, treat or phase out e-waste?
Emissions Trading	Does the company report on its participation in any emissions trading initiative?
Environmental Partnerships	Does the company report on partnerships or initiatives with specialized NGOs, industry organizations, governmental or supra-governmental organizations, which are focused on improving environmental issues?
ISO 14000	Does the company claim to have an ISO 14000 certification?
Environmental Management System Certified Percent	The percentage of company sites or subsidiaries that are certified with any environmental management system.
Environmental Restoration Initiatives	Does the company report or provide information on company-generated initiatives to restore the environment?
Staff Transportation Impact Reduction	Does the company report on initiatives to reduce the environmental impact of transportation used for its staff?
Accidental Spills	Direct and accidental oil and other hydrocarbon spills in thousands of barrels (kbls).
Commercial Risks and/or Opportunities Due to Climate Change	Is the company aware that climate change can represent commercial risks and/or opportunities?
Environmental Expenditures	Total amount of environmental expenditures.
Environmental Provisions	Environmental provisions as reported within the balance sheet.
Environmental Investments Initiatives	Does the company report on making proactive environmental investments or expenditures to reduce future risks or increase future opportunities?
CO_2 Equivalent Indirect Emissions, Scope Three	Total CO_2 and CO_2 Scope Three equivalent emission in tonnes.
Carbon Offsets/Credits	The equivalent of the CO_2 offsets, credits and allowances in tonnes purchased and/or produced by the company during the fiscal year.
Waste Recycling Ratio	The waste recycling ratio as reported by the company.
Self-Reported Environmental Fines	Environmental fines as reported by the company
Estimated CO_2 Equivalents Emission Total	The estimated total CO_2 and CO_2 equivalents emission in tonnes.
CO_2 estimation method	CO_2 estimate method
TRBC used for Median Calculation	TRBC code used to calculate estimate if the Median model is used

Appendix C. History of the Kyoto Protocol (1992-2020)

Year	Keyword	Description
1992	United Nations Framework Convention on Climate Change	In Rio de Janeiro, Brazil, 154 countries signed the United Nations Framework Convention on Climate Change (UNFCCC). The main objective of the UNFCCC was a commitment to stabilize greenhouse gas levels for allowing ecosystems to adapt naturally to climate change.
1995	Berlin Mandate	In Berlin, Germany, nations adopted the Berlin Mandate which is a commitment by developed countries to set specific emission reduction targets, timetables for reducing greenhouse gas emissions, and to outline explicit policies.
1997	Adoption of the Kyoto Protocol	In Kyoto, Japan, member countries signed the Kyoto Protocol which is a comprehensive agreement including specific emission-reduction targets of greenhouse gases for each member country, the framework of a greenhouse gas emissions-trading program and holding future meetings to establish the penalties for violators and the rules of the emissions-trading program.
1998	Negotiating Implementation of the Kyoto Protocol	The member countries held Conferences of the Parties to work out the Protocol's details. For example, in 1998, the Buenos Aires Plan of Action was adopted. It established 140 items which necessitated agreement before ratifying the Protocol.
2001	Withdrawal of the U.S.	In 2001, the Bush Administration announced that the US did not support the Protocol and withdrew the possibility of ratifying it, though, in 1997, the Clinton Administration committed the U.S. to the Kyoto Protocol agreement.
2005	The Kyoto Protocol comes into effect	On February 16, 2005, the Kyoto Protocol formally came into force, committing key industrialized countries, including Japan, Canada, New Zealand, and most European signatories, for reducing or limiting their greenhouse gas emissions.
2008-2012	The First commitment period	The first commitment period started in 2008 and ended in December 31, 2012.
2011	Withdrawal of Canada	In December 13, 2011, Canada announced its withdrawal from the Kyoto Protocol.
2013-2020	The second commitment period	New commitments for Annex I Parties who agreed to take on commitments in a second commitment period from 1 January 2013 to 31 December 2020.

This appendix provides an historical overview of the Kyoto Protocol from the original meeting of nations in 1992.

Table 1. Descriptive Statistics and Bivariate Correlations

Panel A. Descriptive Statistics

Variable	Obs.	Mean	Std. dev.	Min	Q1	Median	Q3	Max
Emissions reduction								
EMREDUC	6,847	0.426	0.309	0.081	0.156	0.279	0.749	0.963
Firm internationalization								
D(FS)	6,847	0.724	0.447	0	0	1	1	1
D(FA)	6,847	0.235	0.424	0	0	0	0	1
FS/S	6,847	0.302	0.279	0	0	0.271	0.512	1
Herfindahl(S)	6,847	0.61	0.297	0.151	0.343	0.531	1	1
Entropy(S)	6,847	0.741	0.607	0	0	0.692	1.234	2.125
FA/A	1,612	0.424	0.262	0.011	0.217	0.396	0.591	1
Herfindahl(A)	2,942	0.716	0.286	0.196	0.442	0.748	1	1
Entropy(A)	2,942	0.512	0.538	0	0	0.445	0.963	1.781
Firm value								
Tobin Q	6,845	2.013	1.145	0.805	1.228	1.644	2.389	6.915
MTB	6,579	3.718	3.838	0.622	1.684	2.649	4.233	27.756
Other characteristics								
Ln(at)	6,845	8.88	1.28	6.36	7.94	8.71	9.715	12.527
Lev	6,845	0.239	0.169	0	0.113	0.226	0.342	0.738
ROA	6,845	0.056	0.077	-0.316	0.025	0.056	0.096	0.247
Capex	6,748	0.054	0.056	0	0.02	0.038	0.066	0.341
FCF	6,787	0.107	0.086	-0.212	0.062	0.103	0.154	0.363
RD/S	6,847	0.04	0.078	0	0	0	0.035	0.415
AD/S	6,847	0.013	0.027	0	0	0	0.013	0.148
PPE	6,776	0.277	0.233	0.003	0.091	0.197	0.415	0.88
Cash	6,758	0.142	0.144	0.001	0.035	0.092	0.2	0.67

Panel B: Bivariate correlations

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
(1) EMREDUC	1										
(2) D(FS)	0.1566**	1									
(3) D(FA)	0.1283**	0.3333**	1								
(4) FS/S	0.1801**	0.6672**	0.1827**	1							
(5) Herfindahl(S)	-0.2418**	-0.7322**	-0.3116**	-0.7976**	1						
(6) Entropy(S)	0.2539**	0.6806**	0.3193**	0.7637**	-0.9772**	1					
(7) FA/A	0.0923**	0.1279**	0.0880**	0.7661**	-0.3645**	0.3526**	1				
(8) Herfindahl(A)	-0.2733**	-0.7435**	-0.7289**	-0.6974**	0.8986**	-0.8786**	-0.3122**	1			
(9) Entropy(A)	0.2828**	0.7042**	0.6943**	0.6833**	-0.8814**	0.8800**	0.2970**	-0.9853**	1		
(10) Tobin Q	-0.0989**	0.1259**	-0.0043	0.1322**	-0.0996**	0.0775**	0.1102**	-0.0931**	0.0718**	1	
(11) MTB	-0.0240	0.0624**	0.0742**	0.0655**	-0.0505**	0.0342**	0.0936**	-0.0811**	0.0663**	0.6222**	1
(12) Ln(at)	0.4664**	-0.0416**	0.1004**	-0.0640**	0.0080	0.0190	-0.0319	-0.1058**	0.1259**	-0.3408**	-0.1555**
(13) Lev	0.0897**	-0.1339**	0.0890**	-0.1638**	0.1067**	-0.0997**	-0.0243	0.0659**	-0.0685**	-0.1975**	0.1419**
(14) Capex	0.0277**	-0.1664**	0.0294**	-0.1303**	0.1559**	-0.1336**	-0.0074	0.1001**	-0.0845**	0.0676**	0.0203
(15) FCF	0.0085	0.0819**	0.0345**	0.0847**	-0.0651**	0.0661**	0.1330**	-0.0619**	0.0525**	0.5024**	0.2662**
(16) RD/S	-0.0014	0.2180**	-0.1546**	0.3327**	-0.2563**	0.2278**	-0.0740**	-0.0448**	0.0395**	0.2780**	0.1028**
(17) AD/S	0.0212	0.0742**	0.1154**	0.0345**	-0.0458**	0.0232	0.1221**	-0.0596**	0.0385**	0.1739**	0.1565**
(18) PPE	0.1893**	-0.2837**	0.0533**	-0.2465**	0.2482**	-0.2104**	-0.0487	0.1684**	-0.1487**	-0.1718**	-0.0914**
(19) Cash	-0.1265**	0.1746**	-0.1064**	0.2808**	-0.2070**	0.1797**	0.0172	-0.0486**	0.0396**	0.4480**	0.1872**
	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)			
(12) Ln(at)	1										
(13) Lev	0.1520**	1									
(14) Capex	-0.0328**	0.0163	1								
(15) FCF	-0.1467**	-0.1997**	0.2979**	1							
(16) RD/S	-0.1962**	-0.2090**	-0.1354**	-0.1144**	1						
(17) AD/S	0.0227	0.0022	-0.0682**	0.1042**	-0.0279**	1					
(18) PPE	0.1269**	0.2487**	0.6595**	0.0677**	-0.2836**	-0.1292**	1				
(19) Cash	-0.3084**	-0.3304**	-0.1706**	0.1072**	0.5567**	0.0704**	-0.4024**	1			

Panel A reports summary statistics for U.S. firms' environmental emissions reduction, firm internationalization, firm value, and firm characteristic variables over 2002–2014. The environmental variable is EMREDUC. Firm internationalization variables are D(FS), D(FA), FS/S, Herfindahl(S), Entropy(S), FA/A, Herfindahl(A), and Entropy(A). Firm value is proxied by Tobin Q and MTB. Other characteristics variables are Ln(at), Lev, Capex, FCF, RD/S, AD/S, PPE, and Cash. Variables are defined in Appendix C. All continuous variables are winsorized at the 1st and 99th percentiles.

Panel B reports bivariate correlations between firm internationalization, emissions reduction, firm value, and other variables over 2002–2014. All continuous variables are winsorized at the 1st and 99th percentiles. ** indicates statistical significance above the 5% level.

Table 2. Baseline regressions of emissions reduction on firm internationalization

	Dependent variable: EMREDUC			
Variable	(1)	(2)	(3)	(4)
D(FS)	0.089***			
	[11.759]			
FS/S		0.156***		
		[10.922]		
Herfindahl(S)			-0.198***	
			[-15.532]	
Entropy(S)				0.093***
				[14.962]
Ln(at)	0.135***	0.134***	0.131***	0.130***
	[51.208]	[50.881]	[48.983]	[48.344]
Lev	-0.064***	-0.058**	-0.068***	-0.064***
	[-2.649]	[-2.419]	[-2.889]	[-2.729]
MTB	0.003***	0.003***	0.003***	0.003***
	[3.090]	[3.074]	[3.422]	[3.510]
ROA	0.279***	0.255**	0.251**	0.259**
	[2.681]	[2.466]	[2.471]	[2.548]
Capex	-0.351***	-0.362***	-0.318***	-0.316***
	[-4.207]	[-4.347]	[-3.841]	[-3.817]
FCF	-0.021	-0.009	-0.022	-0.029
	[-0.215]	[-0.090]	[-0.222]	[-0.303]
RD/S	0.369***	0.323***	0.307***	0.315***
	[6.839]	[5.979]	[5.782]	[5.921]
AD/S	0.03	0.062	0.037	0.101
	[0.238]	[0.496]	[0.304]	[0.826]
PPE	0.315***	0.291***	0.309***	0.301***
	[14.356]	[13.281]	[14.253]	[13.824]
Cash	0.092***	0.072**	0.071**	0.071**
	[3.138]	[2.494]	[2.494]	[2.493]
Constant	-0.897***	-0.854***	-0.667***	-0.856***
	[-30.284]	[-29.004]	[-20.309]	[-29.238]
Obs.	6,486	6,486	6,486	6,486
Adj. R^2	0.397	0.398	0.41	0.409
Industry FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes

This table reports regression results of emissions reduction on firm internationalization variables and control variables over 2002–2014. The dependent variable is EMREDUC. Firm internationalization variables are D(FS), FS/S, Herfindahl(S), and Entropy(S). Control variables are Ln(at), Lev, MTB, ROA, Capex, FCF, RD/S, AD/S, PPE, and Cash. Variables are defined in Appendix C. All continuous variables are winsorized at the 1st and 99th percentiles. Robust *t*-statistics adjusted by Petersen (2009) standard errors are reported in brackets. Industry and year dummies are not reported for brevity. ***, **, * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 3. Alternative estimation methods

	Dependent Variable: EMREDUC					
Variable	2-way clustering	Firm FE	Firm RE	Fama–MacBeth	Prais–Winsten	GMM
FS/S	0.243***	0.120**	0.065**	0.154***	0.085***	1.263***
	[9.844]	[2.316]	[2.241]	[16.486]	[3.766]	[5.077]
Ln(at)	0.116***	0.156***	0.114***	0.132***	0.117***	-0.048
	[19.310]	[11.422]	[18.604]	[23.452]	[24.126]	[-1.242]
Lev	0.041	0.096	0.001	-0.075**	-0.071**	-0.175
	[0.830]	[1.534]	[0.025]	[-2.799]	[-2.410]	[-1.142]
MTB	0.002	0.002	0.003**	0.002**	0.003***	0.010**
	[1.263]	[1.078]	[2.137]	[2.389]	[2.814]	[2.428]
ROA	0.586***	0.452***	0.220**	0.265	0.191***	-0.291
	[3.455]	[4.005]	[2.204]	[1.714]	[2.762]	[-1.138]
Capex	-0.595***	-0.049	-0.067	-0.421***	-0.020	-0.184
	[-5.206]	[-0.399]	[-0.634]	[-4.454]	[-0.244]	[-0.465]
FCF	-0.185	-0.409***	-0.140	0.032	-0.189***	0.550*
	[-1.146]	[-3.333]	[-1.339]	[0.255]	[-2.602]	[1.842]
RD/S	0.397***	-0.063	0.167*	0.336***	0.087	3.685***
	[4.221]	[-0.383]	[1.693]	[6.931]	[1.381]	[3.581]
AD/S	0.205	-0.419	-0.134	0.120	0.035	11.981***
	[0.777]	[-0.650]	[-0.480]	[1.228]	[0.167]	[4.080]
PPE	0.378***	0.042	0.158***	0.301***	0.229***	-1.769***
	[9.086]	[0.339]	[3.142]	[9.046]	[6.698]	[-4.316]
Cash	-0.034	0.215***	0.117***	0.041	0.100***	-0.116
	[-0.681]	[3.664]	[2.859]	[1.270]	[3.560]	[-0.642]
Constant	-0.789***	-1.033***	-0.688***	-0.789***	-0.664***	
	[-14.593]	[-7.463]	[-11.145]	[-14.741]	[-13.217]	
Obs.	6,486	6,486	6,486	6,486	6,486	4579
Adj. R^2	0.325	0.098	0.380	0.385	0.142	

This table reports regression results of environmental emissions reduction on firm internationalization and controls over 2002–2014 under alternative estimation methods. Estimation methods are ordinary least squares (OLS) regression controlling for industry and year fixed effects, two-way clustering (by firm and year), firm fixed effects (FE), firm random effects (RE), Fama–MacBeth (1973) regression, Prais–Winsten (1954) regression, and generalized method of moments (GMM) regression. The dependent variable is EMREDUC. The firm internationalization variable is FS/S. Control variables are Ln(at), Lev, MTB, ROA, Capex, FCF, RD/S, AD/S, PPE, and Cash. Variables are defined in Appendix C. All continuous variables are winsorized at the 1st and 99th percentiles. Robust *t*-statistics (*z*-statistics for GMM estimates) are reported in brackets. Industry and year dummies are not reported for brevity. ***, **, * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 4. Subperiod analysis: Firm internationalization and emissions reduction

Panel A: Pre-APP subperiod analysis

	Dependent variable: EMREDUC			
Variable	(1)	(2)	(3)	(4)
D(FS)	0.113***			
	[5.205]			
FS/S		0.197***		
		[6.628]		
Herfindahl(S)			-0.177***	
			[-5.721]	
Entropy(S)				0.0810***
				[5.259]
Ln(at)	0.107***	0.108***	0.106***	0.105***
	[8.531]	[8.647]	[8.545]	[8.469]
Lev	-0.0976*	-0.0921*	-0.0976*	-0.0959*
	[-1.741]	[-1.652]	[-1.802]	[-1.767]
MTB	0.005**	0.004***	0.004**	0.004**
	[2.456]	[2.611]	[2.549]	[2.467]
ROA	0.164	0.179*	0.169*	0.164
	[1.364]	[1.692]	[1.646]	[1.577]
Capex	-0.249***	-0.250***	-0.245**	-0.255***
	[-2.648]	[-2.672]	[-2.536]	[-2.634]
FCF	0.138**	0.125**	0.124**	0.131**
	[2.415]	[2.475]	[2.337]	[2.313]
RD/S	1.548***	1.418***	1.448***	1.501***
	[5.148]	[4.833]	[4.959]	[5.177]
AD/S	0.125	0.117	0.0723	0.102
	[0.479]	[0.425]	[0.262]	[0.374]
PPE	0.348***	0.319***	0.327***	0.320***
	[7.693]	[6.806]	[7.147]	[6.918]
Cash	-0.0572	-0.0976*	-0.0786	-0.0823
	[-0.980]	[-1.751]	[-1.375]	[-1.471]
Obs.	1,529	1,529	1,529	1,529
Adj. R^2	0.301	0.299	0.301	0.298

Panel B: Post-APP subperiod analysis

	Dependent variable: EMREDUC			
Variable	(1)	(2)	(3)	(4)
D(FS)	0.129***			
	[7.765]			
FS/S		0.217***		
		[7.781]		
Herfindahl (S)			-0.265***	
			[-10.350]	
Entropy (S)				0.123***
				[10.030]
Ln(at)	0.123***	0.122***	0.120***	0.118***
	[20.790]	[20.570]	[20.850]	[20.350]
Lev	0.124**	0.121**	0.0989**	0.104**
	[2.540]	[2.433]	[2.151]	[2.255]
MTB	-0.001	-0.000	-0.000	-0.000
	[-0.415]	[-0.183]	[-0.062]	[-0.0153]
ROA	0.751***	0.711***	0.694***	0.698***
	[4.042]	[3.894]	[3.922]	[3.811]
Capex	-0.353***	-0.382***	-0.333***	-0.338***
	[-3.116]	[-3.476]	[-2.852]	[-2.906]
FCF	-0.149	-0.129	-0.139	-0.145
	[-1.196]	[-1.057]	[-1.172]	[-1.151]
RD/S	1.575***	1.354***	1.358***	1.392***
	[7.594]	[6.173]	[6.577]	[6.700]
AD/S	0.658*	0.709**	0.724**	0.770**
	[1.905]	[2.120]	[2.297]	[2.454]
PPE	0.378***	0.359***	0.378***	0.365***
	[9.077]	[8.512]	[9.354]	[9.032]
Cash	-0.009	-0.0445	-0.0346	-0.0351
	[-0.164]	[-0.761]	[-0.595]	[-0.606]
Obs.	4,951	4,951	4,951	4,951
Adj. R^2	0.347	0.349	0.372	0.369

Panel C. Chow tests for structural break between pre- and post-APP subperiods

Variables	F-stat	p-value
FS/S	26.26	<0.0001
Herfindahl(S)	31.99	<0.0001
Entropy(S)	31.49	<0.0001

This table reports the results from regressing the emissions reduction index on internationalization and controls in two subperiods: before (2002~2005, in Panel A) and after the Asia-Pacific Partnership on Clean Development and Climate (APP) (2006~2014, in Panel B), the goal of which was national pollution reduction, energy security, and climate change concerns, consistent with the principles of the U.N. Framework Convention on Climate Change (UNFCCC). The dependent variable is EMREDUC. Firm internationalization variables are D(FS), FS/S, Herfindahl(S), and Entropy(S). Control variables are Ln(at), Lev, MTB, ROA, Capex, FCF, RD/S, AD/S, PPE, and Cash. Those variables are defined in Appendix C. All continuous variables are winsorized at the 1st and 99th percentiles. Robust *t*-statistics adjusted by firm clustered standard errors (Petersen, 2009) are reported in brackets. Control variables, constant terms, and year dummies are not reported for brevity. ***, **, * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. Panel C reports the *F statistics* of Chow test for any structural break in the coefficients of internationalization variables in Panels A and B.

Table 5. Quasi-natural experiments: Extreme temperature disaster and BP oil spill

Dependent variable: EMREDUC						
	Panel A: ETD			Panel B: BPOS		
Variable	(1)	(2)	(3)	(4)	(5)	(6)
ETD (BPOS)	0.116***	0.193***	0.100***	0.114***	0.172***	0.113***
	(5.019)	(6.563)	(4.247)	(5.287)	(6.717)	(5.242)
FS/S	0.009			0.030		
	(0.219)			(0.946)		
FS/S*ETD (BPOS)	0.066*			0.067**		
	(1.668)			(2.394)		
Herfindahl(S)		-0.029			-0.072**	
		(-0.742)			(-2.395)	
Herfindahl(S)*ETD (BPOS)		-0.096***			-0.064**	
		(-2.670)			(-2.478)	
Entropy(S)			0.014			0.038**
			(0.719)			(2.523)
Entropy(S)*ETD (BPOS)			0.046***			0.027**
			(2.616)			(2.140)
Observations	6,486	6,486	6,486	6,486	6,486	6,486
Adj. R^2	0.378	0.391	0.391	0.378	0.390	0.390
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes

This table reports the impacts of the extreme temperature disaster (Panel A) and BP oil spill (Panel B) on the relation between firm internationalization and environmental emissions reduction over 2002–2014. ETD is a dummy variable equal to 1 after the North American heat wave in 2006 and 0 otherwise. BPOS is a dummy variable equal to 1 after the BP oil spill in 2010 and 0 otherwise. The dependent variable is EMREDUC. Firm internationalization variables are FS/S, Herfindahl(S), and Entropy(S). Control variables are Ln(at), Lev, MTB, ROA, Capex, FCF, RD/S, AD/S, PPE, and Cash. Variables are defined in Appendix C. All continuous variables are winsorized at the 1st and 99th percentiles. Robust *t*-statistics adjusted by firm-clustered standard errors (Petersen, 2009) are reported in brackets. Control variables, constant terms, and year dummies are not reported for brevity. ***, **, * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 6. Firm internationalization and emissions reduction in non-U.S. countries

	Dependent variable: EMREDUC					
Variable	OLS	2-way clustering	Firm FE	Firm RE	Fama–MacBeth	Prais–Winsten
FS/S	0.058***	0.062***	0.053***	0.051***	0.051***	0.044***
	[8.646]	[4.776]	[3.983]	[5.038]	[5.359]	[5.501]
Ln(at)	0.110***	0.109***	0.101***	0.085***	0.109***	0.085***
	[67.777]	[32.198]	[14.186]	[24.179]	[37.214]	[30.001]
Lev	0.001	-0.003	-0.062**	0.021	-0.013	0.031*
	[0.071]	[-0.107]	[-2.074]	[0.967]	[-0.903]	[1.846]
MTB	3.257***	1.785	-1.133	2.450***	2.158	1.127
	[3.933]	[1.330]	[-1.084]	[2.645]	[1.395]	[1.543]
ROA	0.118***	0.074	-0.081**	0.031	0.116**	0.022
	[4.239]	[1.533]	[-2.296]	[0.988]	[2.793]	[1.017]
Capex	0.205***	0.179**	-0.066	0.023	0.221***	0.034
	[4.473]	[2.495]	[-1.035]	[0.419]	[5.701]	[0.868]
PPE	0.088***	0.089***	-0.057*	0.007	0.104***	0.031**
	[7.700]	[3.444]	[-1.776]	[0.318]	[5.582]	[1.981]
Cash	-0.023	-0.008	-0.002	-0.059**	0.012	-0.033*
	[-1.273]	[-0.222]	[-0.048]	[-2.152]	[0.456]	[-1.672]
Constant	-1.214***	-1.176***	-0.960***	-0.850***	-1.187***	-0.823***
	[-43.631]	[-22.407]	[-8.660]	[-15.374]	[-21.616]	[-17.940]
Obs.	15,728	15,728	15,728	15,728	15,728	15,728
Adj. R^2	0.423	0.417	0.070	0.303	0.413	0.145
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes

This table presents regression results of emissions reduction on firm internationalization using firms in 41 non-U.S. countries (Australia, Austria, Belgium, Hong Kong, Brazil, Canada, Switzerland, Chile, Germany, Denmark, Egypt, Spain, Finland, France, United Kingdom, Greece, China, Indonesia, Ireland, Israel, Italy, Jersey, Japan, South Korea, Luxembourg, Mexico, Malaysia, Netherlands, Norway, New Zealand, Philippines, Poland, Portugal, Russia, Saudi Arabia, Singapore, Sweden, Thailand, Turkey, Taiwan, and South Africa). Each country is required to have at least five firms from 2002 to 2014. Estimation methods are ordinary least squares (OLS) regression controlling for industry and year fixed effects, two-way clustering (by firm and year), firm fixed effects (FE), firm random effects (RE), Fama–MacBeth (1973) regression, and Prais–Winsten (1954) regression. The dependent variable is the emissions reduction index (EMREDUC) of non-U.S. firms obtained from the ASSET4 database. The firm internationalization variable is FS/S, obtained from the Worldscope database. Control variables are Ln(at), Lev, MTB, ROA, Capex, PPE, and Cash, also obtained from the Worldscope database. Variables are defined in Appendix C. All continuous variables are winsorized at the 1st and 99th percentiles. Robust *t*-statistics adjusted by firm-clustered standard errors (Petersen, 2009) are reported in brackets. Control variables, constant terms, industry, year and country dummies are not reported for brevity. ***, **, * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 7. The impact of the Kyoto Protocol on the relationship between environmental emissions reduction and firm internationalization for the non-US sample

	Dependent Variable: EMREDUC			
Model	(1)	(2)	(3)	(4)
KP	0.011	0.016	0.063***	-0.007
	[0.567]	[0.882]	[2.721]	[-0.382]
D_FS	0.077***			
	[6.029]			
D_FS*KP	0.090***			
	[6.241]			
FS/S		0.154***		
		[6.167]		
FS/S*KP		0.202***		
		[3.081]		
Herfindahl_S			-0.143***	
			[-6.573]	
Herfindahl_S*KP			-0.071***	
			[-3.037]	
Entropy_S				0.064***
				[5.742]
Entropy_S*KP				0.037***
				[3.064]
Controls	YES	YES	YES	YES
Obs.	6,486	6,486	6,486	6,486
Adj. R^2	0.397	0.398	0.41	0.409
Industry FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES

This table reports the impact of the Kyoto Protocol on the relationship between environmental emission reduction and firm globalization over the sample period of 2002-2014. KP is a dummy variable, equivalent to one after the Kyoto Protocol was enacted in year 2005 and zero otherwise. The dependent variable is the ASSET4 ESG ratings on firms' emission reduction (EMREDUC), which reveals firms' efforts to reduce emissions, such as carbon dioxide (CO2), sulfur oxides (SOx), and nitrogen oxides (NOx). Firm globalization is measured by D(FS), FS/S, Herfindahl(S), and Entropy(S). Control variables include Ln(at), Lev, MTB, ROA, Capex, FCF, RD/S, AD/S, PPE, and Cash. Those variables are defined as in the caption of Table 1. All variables are winsorized at 1%. Robust *t*-statistics adjusted by firm clustered standard errors (Petersen, 2009) are reported in brackets. Control variables, constant terms, industry, and year dummies are not reported for brevity. ***, **, * indicates statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 8. Regressions of KLD environment index score on firm internationalization

	Environmental Index			Environmental FF12 Index		
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
FS/S	0.017***			0.037***		
	(3.818)			(4.739)		
Herfindahl(S)		-0.009**			-0.017**	
		(-2.128)			(-2.310)	
Entropy(S)			0.006**			0.009**
			(2.358)			(2.376)
Ln(at)	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001
	(-1.159)	(-1.041)	(-1.107)	(-0.746)	(-0.509)	(-0.534)
Lev	0.011**	0.011**	0.011**	0.008	0.007	0.008
	(2.336)	(2.270)	(2.280)	(0.873)	(0.777)	(0.781)
MTB	-0.000	-0.000	-0.000	0.000	0.000	0.000
	(-0.476)	(-0.480)	(-0.468)	(0.431)	(0.431)	(0.441)
ROA	0.014***	0.014***	0.014***	0.035***	0.035***	0.036***
	(3.294)	(3.294)	(3.303)	(3.303)	(3.298)	(3.302)
Capex	0.000	0.000	0.000	0.000	0.000	0.000
	(0.389)	(0.296)	(0.323)	(1.422)	(1.330)	(1.338)
FCF	-0.001	-0.001	-0.001	-0.010	-0.009	-0.009
	(-0.714)	(-0.631)	(-0.652)	(-1.519)	(-1.438)	(-1.445)
RD/S	0.002*	0.002*	0.002*	0.004	0.004	0.004
	(1.746)	(1.724)	(1.740)	(1.462)	(1.391)	(1.383)
AD/S	0.088***	0.086**	0.087***	0.238***	0.234***	0.236***
	(2.616)	(2.571)	(2.606)	(3.697)	(3.624)	(3.652)
PPE	0.004	0.004	0.004	0.019*	0.018*	0.018
	(0.688)	(0.646)	(0.644)	(1.743)	(1.651)	(1.635)
Cash	0.011***	0.011***	0.011***	-0.006	-0.004	-0.004
	(2.800)	(2.936)	(2.920)	(-0.701)	(-0.514)	(-0.523)
Constant	0.554***	0.563***	0.554***	0.485***	0.501***	0.484***
	(56.944)	(52.510)	(56.985)	(27.937)	(26.673)	(27.977)
Observations	27,001	27,001	27,001	26,991	26,991	26,991
Adj.R^2	0.508	0.508	0.507	0.423	0.422	0.422
Year FE	YES	YES	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES	YES	YES

This table reports regression results of the Kinder, Lydenberg, and Domini (KLD) environment index score and the Environmental FF12 Index on firm internationalization variables and control variables over 2002–2014. The dependent variable are respectively environment index score and Environmental FF12 Index, constructed by data from the KLD database. Firm internationalization variables are FS/S, Herfindahl(S), and Entropy(S). Control variables are Ln(at), Lev, MTB, ROA, Capex, FCF, RD/S, AD/S, PPE, and Cash. Variables are defined in Appendix C. All continuous variables are winsorized at the 1st and 99th percentiles. . Robust *t*-statistics adjusted by firm-clustered standard errors (Petersen, 2009) are reported in brackets. Industry and year dummies are not reported for brevity. ***, **, * indicate statistical significance at the 1%, 5%, and 10%.

Table 9. Effect of internationalization and emissions reduction on firm value

	Dependent var.: Tobin Q		Dependent var.: MTB	
Variable	(1)	(2)	(3)	(4)
FS/S*EMREDUC	1.101***	0.521***	3.364***	1.386**
	(3.735)	(3.516)	(3.173)	(2.518)
FS/S	-0.136	0.0862	-0.349	0.139
	(-0.780)	(0.956)	(-0.691)	(0.469)
EMREDUC	-0.188*	0.129**	-0.642	0.346
	(-1.749)	(2.207)	(-1.470)	(1.375)
Ln(at)	-0.298***	-0.281***	-0.628***	-0.575***
	(-9.338)	(-20.11)	(-6.800)	(-11.42)
Lev	-0.951***	-0.762***	4.739***	5.203***
	(-3.923)	(-7.429)	(5.476)	(10.29)
Capex	1.379**	3.698***	1.076	7.285***
	(2.399)	(11.19)	(0.670)	(6.622)
Constant	4.788***	4.550***	8.040***	7.577***
	(14.28)	(32.59)	(9.047)	(14.74)
Observations	6,748	6,748	6,569	6,569
Adj. R^2	0.155	0.257	0.069	0.124
Industry FE	No	Yes	No	Yes
Year FE	No	Yes	No	Yes
Two-way clustered Standard error	Yes	No	Yes	No
White's standard error	No	Yes	No	Yes

This table reports the regression results of firm value on firm internationalization, environmental emissions reduction, and their interactive terms over 2002–2014. Dependent variables are Tobin's Q (models (1) and (2)) and MTB (models (3) and (4)). Environmental emission reduction, EMREDUC, reveals firms' efforts to reduce emissions, such as carbon dioxide (CO_2), sulfur oxides (SOx), and nitrogen oxides (NOx). Internationalization is proxied by FS/S, a ratio of foreign sales to total sales. FS/S*EMREDUC is an interactive term between FS/S and environmental emissions reduction. Control variables are Ln(at), Lev, and Capex. These variables are defined in Appendix C. All continuous variables are winsorized at the 1st and 99th percentiles. Robust *t*-statistics are reported in brackets, adjusted either by firm- and year-clustered standard errors in models (1) and (3) or by Petersen's (2009) robust standard error in models (2) and (4). ***, **, * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.